APPENDIX C

METHYL BROMIDE RESIDUES IN FUMIGATED COMMODITIES

The half-lives of methyl bromide residues in commodities after post-harvest fumigation

Commodities	rate (lbs/1000 ft^3)	Fumigation time /temperature	When samples were collected for analysis[a]	Analysis Method[b]	Initial residue level[c]	Half-life[d]	References
Fresh Fruits							
Apple	5	2 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	6.8 ppm	19 hrs	MBIP, 1985a; Hazel, 1988
Avocado (ripe, Fuerte var.)	2	2 hrs/20EC	after 30 min aeration, during 0 to 5 days of storage	F	7.2 ppm	4.6 hrs	Singh *et al.*, 1982
Avocado (ripe, Fuerte var.)	2	4 hrs/20EC	after 30 min aeration, during 0 to 5 days of storage	F	7.5 ppm	5.2 hrs	Singh *et al.*, 1982
Blueberry	3	3 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	3.8 ppm	15.6 hrs	MBIP, 1985a; Hazel, 1988
Blueberry	2	3.5 hrs/16.6EC	during aeration (1-24 hrs)	A	50.8 ppm	1.6 hrs	IR-4, 1983
Blueberry	2	2 hrs/27.2EC	during aeration (1-24 hrs)	A	26.6 ppm	0.8 hrs	IR-4, 1983
Cherry	3	2 hrs/21EC	after 2 hrs aeration, during 2 to 48 hrs of storage at 2.5EC	B	18.1 ppm	4.7 hrs	Tebbets *et al.*, 1983
Cherry	2	4 hrs/21EC	after 2 hrs aeration, during 2 to 48 hrs of storage at 2.5EC	B	14.0 ppm	4.9 hrs	Tebbets *et al.*, 1983
Grape	4	2.5 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	3.3 ppm	23.5 hrs	MBIP, 1985a; Hazel, 1988
Grapefruit	3	3 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	4.4 ppm	2.5 days	MBIP, 1985a; Hazel, 1988
Grapefruit	2	2 hrs	after 15 min aeration, during 2 to 48 hrs of storage at 24 EC	B	9.0 ppm	8.7 hrs	King *et al.*, 1981
Lemon	2.7	2 hrs/20EC	after 2 hrs aeration, during 2 hrs to 31 days of storage	B	4.9 ppm	3.3 days	Hartsell *et al.*, 1989
Lemon	3	3 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	5.0 ppm	1.8 days	MBIP, 1985a; Hazel, 1988
Mango	1	2 hrs/20EC	after 5 min aeration, during 0.17 to 3 hrs storage in fume hood with fan on (24.4 m/min face velocity)	B	4.7 ppm (peel) 2.2 ppm (pulp)	0.3 hrs (peel) 0.4 hrs (pulp)	Stein and Wolfenbarger, 1989

Mango	4	2 hrs/20EC	after 5 min aeration, during 0.17 to 3 hrs storage in fume hood with fan on (24.4 m/min face velocity)	B	21.2 ppm (peel) 20.6 ppm (pulp)	1.8 hrs (peel) 2.4 hrs (pulp)	Stein and Wolfenbarger, 1989
Nectarine	3	2 hrs/21EC	after 2 hrs aeration, during 2 to 48 hrs of storage at 2.5EC	B	24.4 ppm	3.1 hrs	Tebbets *et al.*, 1983
Nectarine	2	4 hrs/21EC	after 2 hrs aeration, during 2 to 48 hrs of storage at 2.5EC	B	24.8 ppm	3.0 hrs	Tebbets *et al.*, 1983
Nectarine	2	2 hrs/15.5EC	after 2 hrs aeration, during 2 to 168 hrs of storage at 2.5EC	B	13.8 ppm	18.9 hrs	Harvey *et al.*, 1982
Nectarine	4	2 hrs/15.5EC	after 2 hrs aeration, during 2 to 168 hrs of storage at 2.5EC	B	26.7 ppm	17.0 hrs	Harvey *et al.*, 1982
Orange	3	3 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	4.7 ppm	2.4 days	MBIP, 1985a; Hazel, 1988
Peach	5	2 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	2.2 ppm	15.8 hrs	MBIP, 1985a; Hazel, 1988
Peach	3	2 hrs/21EC	after 2 hrs aeration, during 2 to 24 hrs of storage at 2.5EC	B	24.4 ppm	2.5 hrs	Tebbets *et al.*, 1983
Peach	2	4 hrs/21EC	after 2 hrs aeration, during 2 to 24 hrs of storage at 2.5EC	B	15.8 ppm	2.7 hrs	Tebbets *et al.*, 1983
Peach	2	2 hrs/15.5EC	after 2 hrs aeration, during 2 to 168 hrs of storage at 2.5EC	B	18.4 ppm	18 hrs	Harvey *et al.*, 1982
Peach	4	2 hrs/15.5EC	after 2 hrs aeration, during 2 to 168 hrs of storage at 2.5EC	B	37.6 ppm	17.5 hrs	Harvey *et al.*, 1982
Pear	5	2 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	10 ppm	22 hrs	MBIP, 1985a; Hazel, 1988
Pear	3	2 hrs/21EC	after 2 hrs aeration, during 2 to 48 hrs of storage at 2.5EC	B	44.0 ppm	8.4 hrs	Tebbets *et al.*, 1983
Pear	2	4 hrs/21EC	after 2 hrs aeration, during 2 to 48 hrs of storage at 2.5EC	B	58.1 ppm	7.1 hrs	Tebbets *et al.*, 1983
Plum	4	2.5 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	6.3 ppm	21.8 hrs	MBIP, 1985a; Hazel, 1988

Plum	3	2 hrs/21EC	after 2 hrs aeration, during 2 to 48 hrs of storage at 2.5EC	B	34.2 ppm	12.5 hrs	Tebbets *et al.*, 1983
Plum	2	4 hrs/21EC	after 2 hrs aeration, during 2 to 48 hrs of storage at 2.5EC	B	30.4 ppm	13.9 hrs	Tebbets *et al.*, 1983
Plum	2	2 hrs/15.5EC	after 2 hrs aeration, during 2 to 168 hrs of storage at 2.5EC	B	18.0 ppm	17.7 hrs	Harvey *et al.*, 1982
Plum	4	2 hrs/15.5EC	after 2 hrs aeration, during 2 to 168 hrs of storage at 2.5EC	B	26.7 ppm	17.8 hrs	Harvey *et al.*, 1982
Raspberry	3	3 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	0.28 ppm	1.5 days	MBIP, 1985a; Hazel, 1988
Strawberry	3	3 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	0.32 ppm	1.6 days	MBIP, 1985a; Hazel, 1988
Strawberry	3	2 hrs	during 1 to 24 hrs aeration at 0EC	C	60 ppm (Tioga) 44.2 ppm (Tuft)	1 hr (Tioga) 2 hrs (Tuft)	IR-4, 1982
Strawberry	3	3 hrs	after 45 min aeration, during 0-24 hrs of storage	B	7.1 ppm	2.0 hrs	MBIP, 1984b
Strawberry	3	3 hrs	during 0.75 to 3 hrs aeration	B	9.0 ppm	0.4 hrs	MBIP, 1984b
Vegetables and Herbs							
Basil	3	12 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	2.2 ppm	1.7 days	MBIP, 1985a; Hazel, 1988
Bean-dry	3.5	24 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	0.77 ppm	9.2 days	MBIP, 1985a; Hazel, 1988
Broccoli	3	3 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	0.004 ppm	3.1 days	MBIP, 1985a; Hazel, 1988
Carrot	3	6 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	2.0 ppm	21.7 hrs	MBIP, 1985a; Hazel, 1988
Chive	3	12 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	0.13 ppm	1.7 days	MBIP, 1985a; Hazel, 1988
Corn	3	24 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	3.4 ppm	5.4 days	MBIP, 1985a; Hazel, 1988

Cucumber	3	4 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	0.34 ppm	2.0 days	MBIP, 1985a; Hazel, 1988
Dill	3	12 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	1.9 ppm	1.5 days	MBIP, 1985a; Hazel, 1988
Garlic	3	3 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	0.16 ppm	1.4 days	MBIP, 1985a; Hazel, 1988
Melon	3	3 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	2.9 ppm	1.6 days	MBIP, 1985a; Hazel, 1988
Pea-dry	2	24 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	0.29 ppm	7 days	MBIP, 1985a; Hazel, 1988
Potato	3	6 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	1.2 ppm	1.2 days	MBIP, 1985a; Hazel, 1988
Sage	3	12 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	2.5 ppm	2.1 days	MBIP, 1985a; Hazel, 1988
Soy bean	2	24 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	0.32 ppm	5.4 days	MBIP, 1985a; Hazel, 1988
Sugar beet	3	4 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	0.61 ppm	1.0 day	MBIP, 1985a; Hazel, 1988
Tomato	3	4 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	1.8 ppm	1.3 days	MBIP, 1985a; Hazel, 1988
Dried Fruits							
Date (bulk, non-pitted)	1.5	24 hrs/10EC	after 24 hrs aeration, during 1 to 9 days of storage	B	1.5 ppm	2.0 days	Hartsell *et al.*, 1989
Date (packaged, pitted)	1.5	24 hrs/10EC	after 24 hrs aeration, during 1 to 9 days of storage	B	3.0 ppm	2.2 days	Hartsell *et al.*, 1989
Dried Apricot (bulk)	1.5	24 hrs/10EC	after 24 hrs aeration, during 1 to 6 days of storage	B	2.4 ppm	1.2 days	Hartsell *et al.*, 1989
Dried Apricot (packaged)	1.5	24 hrs/10EC	after 24 hrs aeration, during 1 to 13 days of storage	B	5.4 ppm	2.7 days	Hartsell *et al.*, 1989
Fig	1.5	24 hrs/10EC	after 24 hrs aeration, during 1 to 13 days of storage	B	3.4 ppm	2.1 days	Hartsell *et al.*, 1989

Prune (bulk)	1.5	24 hrs/10EC	after 24 hrs aeration, during 1 to 6 days of storage	B	3.3 ppm	1.6 days	Hartsell *et al.*, 1989
Prune (packaged)	1.5	24 hrs/10EC	after 24 hrs aeration, during 1 to 9 days of storage	B	4.2 ppm	2.0 days	Hartsell *et al.*, 1989
Raisin (bulk)	1.5	59.5 hrs/13-14EC	after 8 hrs aeration, during 1 to 8 days of storage	B	4.5 ppm	1.6 days	Hartsell *et al.*, 1989
Raisin (packaged with liner	1.5	24 hrs/10EC	during 1 to 13 days of storage	B	1.8 ppm	4.3 days	Hartsell *et al.*, 1989
Raisin (bulk)	1.5	24 hrs/10EC	during 1 to 8 days of storage	B	2.2 ppm	3.3 days	Hartsell *et al.*, 1989
Nuts and Beans							
Almond	1	12 hrs/10EC	during 4 to 72 hrs of aeration with the first 8 hrs aeration with a fan, and then the door was left open	B	9 ppm (kernel) 28 ppm (shell)	1.5 days (kernel) 12.6 hrs (shell)	Hartsell *et al.*, 1983
Cocoa bean	2.2	24 hrs	during storage at 1 to 17 days at ambient temperature	D	1.7 ppm	4.2 days	Schumacher, 1985
Cocoa bean	8.7	20 hrs/15EC	during "airing" 0 to 72 hrs	E	22.9 ppm	1.8 days	Fairall and Scudamore, 1980
Pecan	3.5	24 hrs/10EC	after 24 hrs of aeration, during 1 to 8 days of storage	B	3.4 ppm	2.1 days	Hartsell *et al.*, 1989
Pistachio nut	2	24 hrs/15.5EC	after 24 hrs of aeration, during 1 to 13 days of storage at 15.5EC	B	28.9 ppm	1.9 days	Hartsell *et al.*, 1986
Pistachio nut	1.5	24 hrs/26.6EC	after 24 hrs of aeration, during 1 to 13 days of storage at 26.6EC	B	10.1 ppm	2.2 days	Hartsell *et al.*, 1986
Pistachio nut	2.5	24 hrs/26.7EC	after 24 hrs of aeration to 120 hrs of storage	B	14.9 ppm	1.6 days	MBIP, 1985b
Walnut (inshell)-small scale trial	3.5	4 hrs/15.5EC	after aeration, during 4 hrs to 13 days of storage under ambient conditions 14-24EC	B	53.8 ppm	1.7 days	Nelson *et al.*, 1984
Walnut (inshell)-large scale trial	3.5	4 hrs/15.5EC	after 4 hrs of aeration, during 0 to 21 days of storage at 10EC	B	74.4 ppm	4.1 days	Hartsell *et al.*, 1984
Walnut (inshell)-large scale trial	3.5	4 hrs/15.5EC	after 4 hrs of aeration, during 0 to 21 days of storage at 32EC	B	74.4 ppm	1.2 days	Hartsell *et al.*, 1984

Grains							
Maize (white)	0.45	90 hrs/15EC	during "airing" 0 to 48 hrs	E	18.0 ppm	14.4 hrs	Fairall and Scudamore, 1980
Oats	0.45	90 hrs/15EC	during "airing" 0 to 48 hrs	E	18.8 ppm	14.8 hrs	Fairall and Scudamore, 1980
Rice	3	24 hrs	after 18 hrs aeration, during 1 to 7 days of storage	B	0.41 ppm	9.2 days	MBIP, 1985a; Hazel, 1988
Rice	0.45	90 hrs/15EC	during "airing" 0 to 7 hrs	E	8.7 ppm	3.8 hrs	Fairall and Scudamore, 1980
Wheat	1.5	24 hrs/21EC	after aeration of 4 hrs, during 0 to 24 hrs of storage	B	91.3 ppb	19.5 hrs	CMA, 1984
Wheat	8.7	20 hrs/15EC	during "airing" 0 to 72 hrs	E	27.6 ppm	24.8 hrs	Fairall and Scudamore, 1980

[a] When indicated as aeration, a high velocity fan or blower was used to enhance the off-gassing of methyl bromide from the commodity. During storage, a fan of lower velocity or none was used to circulate the air. "Airing" conditions were not specified in the data reported by Fairall and Scudamore, 1980.

[b] Analysis Methods were: A. not specified; B. head-space method by King *et al.*, 1981; C. partition with methylene chloride, Heuser and Scudamore, 1970; D. hexane volatile trap reflux; and E. partition with acetone/pentane.

[c] Initial residue level was the residue level at the earliest sampling time.